Results: The Monte Carlo simulations were performed for the HDR Photon Needle of U_a=50 kV, and I_a=20 μA, and for filters of paraboloid and spherical (bowl) shape made from the PMMA and polystyrene material. The results indicate that increasing filter thickness leads to a decrease in average dose, but improves the uniformity of dose distribution on the chosen surface.
Optimal isotropy was obtained with a filter of 5mm thickness, with an average dose of 1 Gy/min. and standard variation <6%. Further improvement of the uniformity of dose distribution may be obtained by modification of the filter's shape. The estimated, time needed to attain a deposited dose of 20 Gy on a circular surface that is 40 mm in diameter) is approximately 10 minutes, assuming that the HDR Photon Needle is working at full power.
Measurements to verify results of that calculation are now being performed.
Conclusions: An HDR Photon Needle with upgraded corrective filters may thus be regarded as a compact, low-cost, low-energy X-ray source, which assures uniformity of dose distribution in treating skin cancers solution.

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Dependence of jaws-only and MLC-based IMRT quality on PTV shape complexity: A comparison using a complexity index

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Purpose/Objective: As jaws-only (JO) IMRT does not require an MLC but promises the clinical benefits of intensity modulation, it can be an attractive option for under-resourced centers. Previous studies have investigated various aspects and examples of JO-IMRT but the relative performances of JO- and MLC-IMRT, as PTV shapes become increasingly complex, have not been established yet in a quantitative way. As JO-IMRT has fewer degrees of freedom for conforming to PTVs, this work aims to investigate this dependence systematically using a practical shape complexity index (SCI).
Materials and Methods: Direct aperture optimization was used for both JO- and MLC-IMRT in the Prowess Panther treatment planning system (version 5.2). In order to remove the effects of linear accelerator differences, two 6 MV beam models of the same Siemens Oncor machine (one JO and the other with 1 cm wide leaves) were commissioned in Panther. The same beam orientations with 9 equispaced gantry angles were used in all cases. First a prostate cancer patient was planned for JO- and MLC-IMRT using identical planning parameters and objectives. Then the plan comparison was repeated with the PTV replaced in turn by 10 shapes of varying complexity. After testing the accuracy of Panther's volume calculations, the SCI was estimated using the formula S^3/(36.pi.V^2), where S and V were the surface area and volume of each shape, respectively. S was approximated by the volume of a 1 mm thick shell around each PTV. Various plan quality evaluation quantities were then computed.
Results: Averaged over the 11 PTVs, conformity and homogeneity were only slightly worse for JO-IMRT compared to MLC-IMRT, their indices being 2% and 5% higher, respectively. However, in all cases, PTV and organ-at-risk doses were found to be acceptable by RTOG criteria. Total MU was 10% higher in JO-IMRT. SCI increased with increasing amounts of observed shape complexity. Its value ranged between 0.8 and 5.5 for the studied PTVs. Positive correlations were observed for both conformity and homogeneity indices with increasing SCI for both JO- and MLC-IMRT ($r > 0.94$, $p < 0.001$), i.e., PTV dose conformity and homogeneity worsened as SCI increased. However, differences between JO- and MLC-IMRT in PTV conformity and homogeneity were found to be very weakly dependent on SCI while a stronger dependence was seen for MU efficiency.
Conclusions: The calculated SCI was shown to be a useful and practical index for estimating PTV shape complexity. Under the above conditions and within the range of complexities studied here, clinically acceptable plans in terms of PTV dose conformity and homogeneity and organ-at-risk dose can be obtained with JO-IMRT even for complex PTV shapes. However, there is a reduction in MU efficiency with this technique.

Electronic Poster: Physics track: Radiation protection, out-of-field dosimetry and secondary cancer induction

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Investigation of out-of-field dose in high-energy electron beams used in external radiotherapy

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Purpose/Objective: The purpose of this work is to evaluate experimentally the peripheral dose outside applicators at the patient level, in different high-energy electron beams used in external-beam-radiotherapy.
Materials and Methods: Commissioning was performed for 6,9,12 and 18 MeV electron beams on three linear accelerators VARIAN 2300C/D (VARIAN applicator), Siemens Primus KD2 (DEVA applicator) and Siemens Oncor (applicator EA3).
The peripheral dose was measured in a water phantom as a function of off-axis distance from 5cm to 65cm from the field edge for SSD=100cm. Thermoluminescent TLD-700 powder dosimeters were used. Measurements were made at both 1cm and 10cm depths, using applicator sizes from 6x6cm^2 to 20x20cm^2, the results assuming that the TLD signal is proportional to the dose.
Results: Whatever the field size and beam energy, a peak dose spot appeared at 15cm from the field edge for the